Project Summary

The project aims to develop biodegradable nanofibrous materials for use in tissue engineering of blood vessels. The material is intended to have dual functionality: antibacterial and anti-inflammatory.

Cardiovascular diseases account for 31% of all deaths globally, which translates to approximately 17.9 million per year. Many patients require surgical procedures, such as coronary artery bypass grafting, which are associated with the risk of complications and limited availability of material for transplantation. There is a high demand for small-diameter vascular implants, which would be an alternative to autologous transplants.

The specific objectives of the project include: (1) developing a methodology for manufacturing biodegradable fibrous materials with a given degradation rate, (2) developing two alternative systems for drug release from nanofibers, (3) developing a methodology for functionalization of nanofibers, (4) analyzing the properties of the material *in vitro* and *in vivo* conditions.

The nanofibrous structure would promote the colonization of the material by the patient's cells, leading to the gradual reconstruction of the structures of the blood vessel walls. In this phase, it is very important to limit inflammatory processes and the risk of microorganism development. Therefore, the material, apart from anti-thrombogenic agents, will be enriched with antibacterial and anti-inflammatory compounds, limiting these processes. In the longer term, the development of innovative nanofibrous materials may significantly improve the results of treatment of patients with cardiovascular diseases, increasing the availability of effective vascular grafts.

The study will be conducted as part of cooperation between the Warsaw University of Technology (WUT) and the University Hospital Erlangen (UKER).